MAIN ROADS IN URBAN AREAS

Bikes and pedestrians

Finnish National Road Administration

Helsinki 1991

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Summary

This report discusses the general planning principles and geometric design of bike and pedestrian ways in urban areas. Finnish uses the word 'kevytliikenne' (light traffic) to describe bicycle and pedestrian traffic. This report therefore uses the term 'light traffic' for convenience. The report covers planning principles, principles for segregating light traffic from motor traffic, and the design values for cross-section and alignment. Planning of intersections between light-traffic routes, and between light and motor traffic, is considered in terms of sight distances and technical design.

The report is based on the current guidelines and planning practice of the Finnish National Road Administration (FinnRA) and municipalities.

Foreword

Charting the principles for planning light-traffic routes connecting with main roads formed one part of the work being done to establish planning standards for main roads and highways in urban areas. As part of this project, separate reports are being published on the technical planning principles involved in the following:

1. Planning and design considerations
2. Alignment
3. Cross-section
4. At-grade intersections
5. Interchanges
6. Light traffic
7. Mass transit
8. Highways and the environment

Light traffic uses either main routes or local routes. The main problems of planning are to decide the principles (along or across the road) and methods for segregating light from motor traffic, and to determine the quality class of roads (width, gradients, sight distances). The working group in charge of the project includes in its report proposals for the main planning principles and the arguments for them, basing themselves on current guidelines and planning practices. The project group working on standards for main roads and highways will be using the present findings in the general guidelines on roads and highways to be issued at some future date.

The working group responsible for the present report was as follows:

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Helsinki, December 1991

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Contents

1 THE LIGHT-TRAFFIC NETWORK

1.1 Aims and route classification

Finnish uses the word 'kevytliikenne' (light traffic) to describe bicycle and pedestrian traffic. This report therefore uses the term 'light traffic' for convenience. The aim is to create a comprehensive and continuous light-traffic network in built-up areas in order to enhance the safety and travel comfort of users. Journeys connected with school, shopping, work, errands, outdoor recreation and leisure should be possible on foot or by bicycle. Individual routes should be planned for all user groups (children, senior citizens, the handicapped).

The light-traffic network is made up of light-traffic routes and sometimes motor-vehicle roads with little traffic (e.g. residential and access streets), used as parts of the light-traffic route.

Light-traffic links can be classified as follows, according to their function in the network:

CLASS	FUNCTION
MAIN ROUTE	Links various parts of a built-up area together and serves marily cycling (moped riding) that is either regional or long-tance, between parts of the area.
LOCAL ROUTE	Carries internal light traffic in the town district or other area, or between adjacent areas. Substantial pedestrian traffic.
RECREATIONAL ROUTE	Serves outdoor recreation on foot by bicycle, or on skis. form part of some other route network.

Light-traffic routes may accompany main roads for motor traffic, or be completely separate.

1.2 Route standard

Light-traffic routes must be safe and easy to use, and their utilization rate must be as high as possible. They must be planned to ensure that:

- connections are felt to be natural, pleasant to use and safe;
- arrangements are straightforward and support existing traffic rules;
- arrangements result in safe and smooth-flowing light traffic, with safety taking priority (though any compromise over smooth flow must not result in incorrect traffic behavior);
- maintenance requirements are taken into consideration and solutions work well;
- arrangements are so clear that even those with little traffic sense (e.g. children) can use them properly;
- the alignment and conditions of a light-traffic route must be roughly the same standard as (or better than) the motor-vehicle road running alongside it, to ensure the highest possible utilization rate;

- the requirements of various user groups (e.g. the handicapped) are taken into account.

The functional classification of presupposes certain standard criteria, as follows:

Main route:
Planning is based on the needs of bicyclists, but the route also thereby meets the quality requirements of other user groups. Good bicycling conditions depend on the following factors:
- short, smooth-flowing and even-quality connections, separate from motor traffic, between different parts of a built-up area
- safe crossing points where delay to bicyclists is minimized
- gentle inclines and curves
- sufficient sight distance
- clear signs
- good lighting
- even, hard and non-skid surfacing without curbs
- a pleasant, attractive environment shielded from splashing and other hazards
- good winter condition.

Local route:
In addition to the above, planning must take the needs of various pedestrian groups into account (e.g. senior citizens, children, the handicapped). The demands made on the geometry are not as high in all respects as in the case of main routes.

Recreational route:
If the recreational route is part of a main network, it must meet the quality requirements for that network. Elsewhere, a recreational route may follow the topography more closely, can be narrower than other routes, and usually has an unbound pavement (e.g. stone ash).

2 SEGREGATION OF LIGHT TRAFFIC

2.1 Light traffic and motor traffic

Pedestrian and bicycle traffic along main roads and highways is invariably segregated from motor traffic. This can be achieved either with a walk/bicycle path with a curb, elevated from the traveled way, or with a light-traffic path segregated from the road by a sidestrip, depending on the location and the surroundings. The light-traffic route along divided highways and other principle roads is always completely separate. Along the main streets in downtown areas, a route with a curb, elevated from the traveled way, is also possible.

The following table can be used in deciding whether to segregate moped traffic from motor traffic:

Main road speed limit	Moped's place in the cross-section Traffic volume along outermost lane (veh/d) < 2000	2000-4000	> 4000
50 kph	on traveled way	on traveled way if width of lane + paved shoulder ≥ 4.0 m otherwise on light-traffic route	on light-traffic route
60 kph	on traveled way if width of lane + paved shoulder ≥ 4.0 m otherwise on light-traffic route	on light-traffic route	-"-
> 60 kph	on light-traffic route	-"-	-"-

In deciding where to place moped traffic, the route standard class, width of shoulder and how moped traffic is dealt with in areas close to a main road must all be taken into account. If it seems the right choice for the moped rider, moped traffic can be channeled along a street or road parallel to the main road, rather than along a light-traffic route. Routes for mopeds must form distinct entities. In general, mopeds should be led across main roads through grade-separated arrangements for light traffic, even if this means increasing the volume of mopeds allowed on light-traffic routes parallel with main road to some extent.

2.2 Pedestrians and bicyclists

Generally speaking, light-traffic routes are combined pedestrian/bicycle ways with traffic in both directions. Segregation of pedestrians and bicyclists may sometimes be necessary for reasons of safety or smooth flow, e.g. along long, open sections of the route. Very short sections must not be marked differently from the rest of the route.

Decisions to segregate pedestrians from bicyclists must also take into account the practice followed elsewhere in the locality.

The following are some of the arguments in favor of segregation as the cross-section solution for a given section of the route:
- the route is used for fast, long-distance cycling or mopeding, and pedestrians also use the route whose safety should be a particular concern (the handicapped, children, senior citizens)
- high volumes of both pedestrians and bicyclists.

Segregation of pedestrians and bicyclists is usually necessary where buildings front onto the light-traffic route and the peak traffic volume is > 2000 units/day. The light-traffic route is then usually an elevated way with curb close to the motor traffic traveled way, with a < 5 m dividing strip.

2.3 Number of light-traffic routes, and choice of side

The general premises for deciding on the number of light-traffic routes along main roads, and choosing the side are as follows:

- light traffic should be arranged so that no light traffic needs venture onto the traveled way;
- there should be a distinct and continuous main route for long-distance light traffic alongside main roads.

One or two sides

The light-traffic arrangements along a main road can be solely on one side, if there is only land use along one side. If there is land use along both sides, there should be light-traffic routes along both sides, too. However, if the land use along the road generates very little light traffic and it can be safely channeled to the route along the other side of the road, a one-side solution is possible.

Choice of side

The main route along a main road or highway should be chosen so as to serve land use as effectively as possible and to link up with the rest of the network. The standard of the main route, the space available for it and interchange arrangements also affect the choice of side. Changes from one side to the other should be avoided. Over short distances (< 0.5 km) the side of the main route must not be changed despite the fact that there is no land use or route crossings there, even if there is land use on the opposite side.

A route serving local traffic can sometimes be replaced by, say, an adjacent parallel street, or the connection can be along roads or other routes with little traffic, even if these do not run along the main highway. In an area of land use generating light traffic, the connection must be continuous and links with the main route distinct. If land use is interrupted only over a short distance (< 1.0 km) there is usually good reason to continue the route through such stretches.

2.4 Crossings

Choice of light-traffic crossings depends on the speed and volume of motor traffic, the volume and composition of light traffic and the general surroundings.

The following diagram shows the choice of crossing type according to two different standard classes. The standard 'good' should be chosen if the route is used for journeys to school, or a large number of its users are children, senior citizens or the handicapped, or if the crossing point is heavily used otherwise. A 'good' standard should also be chosen if the intersection is a large one, or is part of a main recreational route. The classification in the diagram is only rough, so real choices must be made case by case.

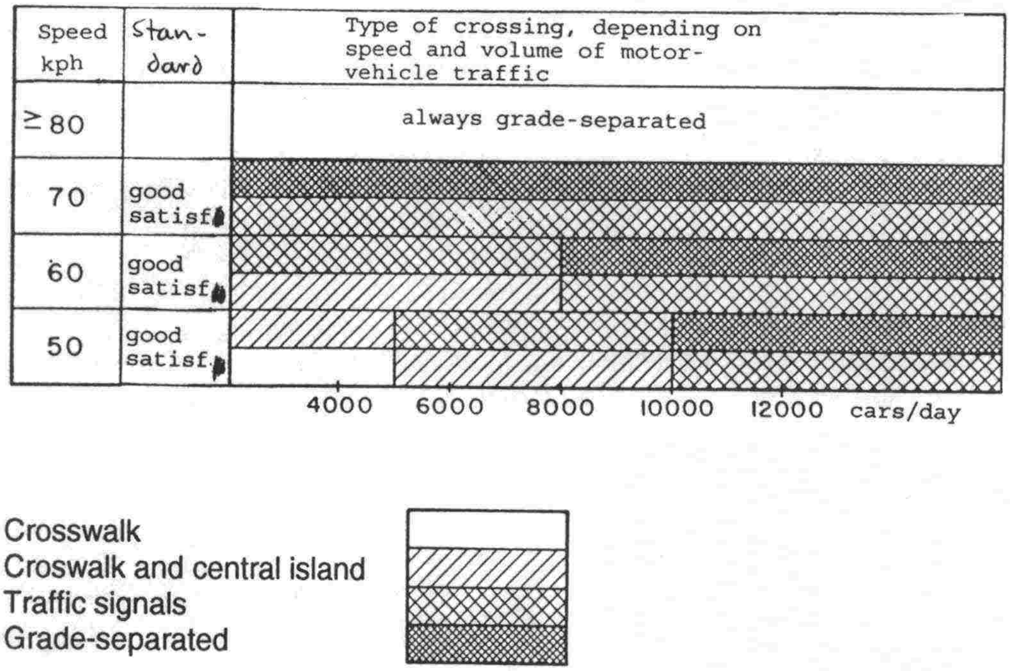


Diagram 1. Choice of crossing type

The following must be taken into account in using the diagram:

- At main-road intersections, the crossing type chosen for a light-traffic route at a crossing between the main road and a secondary road is usually of the same type as that for the main road.

- If the number of lanes to cross is > 3. the crosswalk must have a central island.

- At large intersections between very busy main roads, light traffic should for safety reasons be on a different level from both the main road and the secondary road, instead of being signal-controlled.

Along main roads and highways, crosswalks should preferably be at intersections. If there is a mid-stretch crosswalk, there must be good sight distances at that point. If the permitted speed along a stretch of road without traffic signals is over 60 kph, and it is impossible to provide a grade-separated crossing, the speed limit must be reduced to 60 kph before the crosswalk.

In choosing the location for interchanges (grade-separated crossings), special attention must be paid to ensuring that gradients are low and that the location fits in well with the rest of the light-traffic network.

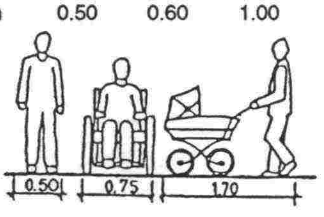
At interchanges for motor traffic, light traffic should be channeled along a different level from cars. In the case of at-grade intersections between ramps and a crossing road, light traffic can also be conducted at grade across the ramp. When there are large traffic volumes, intersections must have signals.

3 CROSS-SECTION

3.1 Space requirement

The cross-section of light-traffic routes is dictated by the amount of space needed for pedestrians and bicyclists. The minimum underpass clearance (3.0 m) is the sum of the height of maintenance vehicles (2.4 m), the travel margin (0.3 m) and a further safety margin (0.3 m). The space needed by a moped driver is the same as for a bicyclist. The space that may be needed by the handicapped (e.g. a wheelchair) must also be taken into account. The basic measurements used for design purposes are those in Diagram 2, in which 'length' refers to horizontal length in the case of users other than pedestrians.

	Pedestrian	Pdstn + baby carriage	Pdstn + guide dog	Wheel-chair
Length	2.00	1.70	-	1.10
Width	0.50	0.60	1.00	0.75



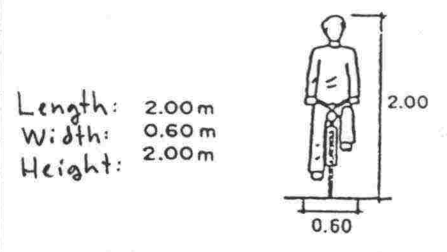
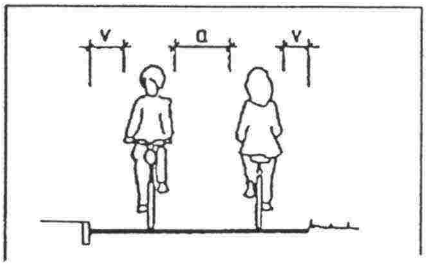


Diagram 2: Basic design values for light traffic

The term 'traffic space' is used to mean the width of the surfacing used by traffic. In the case of light traffic, this space is calculated using the basic traffic unit values plus a clearance margin between these units. The clearance margins for different movement types are given in the table below. In the case of A, pedestrians and bicyclists do not need to allow for each other even when passing. In B, some care musmust be taken when passing and meeting other users.

Clearance margin	Type of movement	
	A	B
v = edge	0.20	0.10
curb	0.35	0.20
a = pdstn - pdstn	0.40	0.25
bicyclist - pdstn	0.60	0.30
bicyclist - bicycl	0.85	0.40



a = distance between road users

v = distance between road user and edg of road

3.2 Route widths

The minimum width of pathways for light traffic is dictated by the actual traffic situation, measured by the volume and composition of the traffic, and the desired standard. The guideline traffic situations and required travel space widths are given in the following table. The standard 'good' corresponds to movement type A and standard 'satisfactory' to type B.

Volume of summertime light traffic (units/day)	Traffic situation	Travel space (m)	
		Good	Satisfactory
$\leq$ 2000	pdstrn + 2 bicycl	3.50	3.00
> 2000	2 pdstrn + 2 bicycl	4.00	3.50
	2 pdstrn [1)]	2.00	1.5 - 2.0
	2 bicycl [1)]	2.50	2.00

[1)] pdstrn and bicycl segregated by e.g. stone paving

The volume of light traffic is the same as the figure in summer or other figure for a key period in terms of pathway design. When pedestrians and bicyclists are segregated, the way this is done (width of dividing strip) also affects the total width of the pathway.

On curves along steep inclines and at other curves where bicycle speeds tend to be high, 3.0-3.5 m pathways are made 0.5 m wider.

For safety and comfort, a certain amount of free space is needed outside the travel space proper. On light-traffic routes, the minimum distance of this free space from the side edge of the travel space is 0.25 m. At cramped points, traffic signs may extend to the edge of the travel space if use of cleaning and maintenance equipment and emergency service vehicles allows it. Diagram 3 gives examples of how free space can be arranged along light-traffic routes.

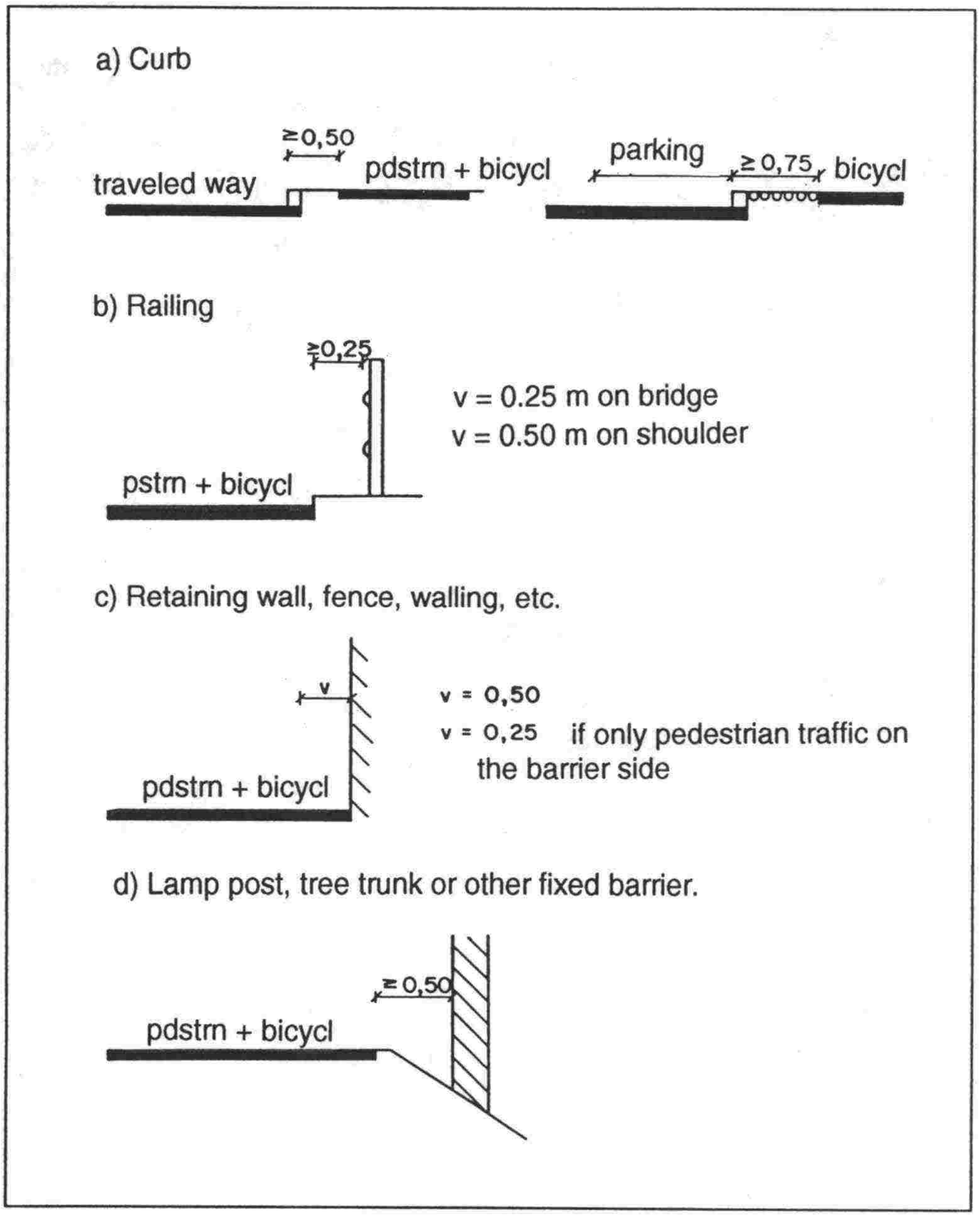
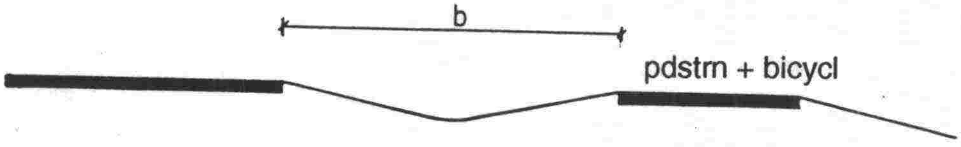


Diagram 3: Free space along light-traffic route.

3.3 Sidestrip

The design and width of a sidestrip depends, for instance, on the importance of the motor traffic road, the speed level and the available space. If space allows, the aim is to provide separate light-traffic routes. The dividing strip between the light-traffic route and the motor traffic route is designed to suit the surroundings.

Segregated route

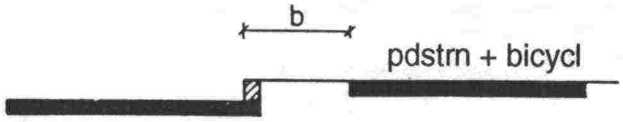


- speed limit $\leq$ 60 kph, b $\geq$ 5 m (minimum 3 m)
- speed limit $\geq$ 70 kph, b usually 7-10 m

The 'rule of thumb' is that the minimum width of a dividing strip in meters should be $\geq$ road speed limit/10.

An elevated light-traffic route connected to the traveled way by a curb is possible in a built-up area. Either lack of space prevents the construction of a separate route or then the street space is arranged in this way for townscaping reasons. The speed along the motor traffic road is $\leq$ 80 kph. In the case of an elevated route, the minimum dividing strip widths are:

Elevated route



Speed limit (kph)	b (m)
$\leq$ 50	$\geq$ 0.5
60	$\geq$ 1.0
70 - 80	$\geq$ 2.0

The construction method for the dividing strip, depending on the minimum width, is:

- grass b $\geq$ 2.0 m
- paving b $\geq$ 0.5-1.0 m
- row of trees b $\geq$ 2.0 m
- bushes b $\geq$ 2.0 m

It may be necessary for safety reasons to have a railing along an exceptionally narrow dividing strip, especially on curves, if the road speed limit is $\geq$ 60 kph.

3.4 Snow sidestrip

Road/street space planning must take account of the space needed for plowed snow. In open countryside, snow is plowed onto the dividing strip; in the case of a light-traffic route, it is also plowed onto the dividing strip or off the road. A dividing strip width of 5 m is usually enough to take plowed snow (see Cross-section report).

Where space is limited, overall road cross-section planning must consider the likely amount of snow, the space needed to hold it and how this will be managed. When snow is kept on dividing strips, the proportion of the light-traffic route that must remain usable must be

- 3/4, if the snow is not removed, or
- 2/3, if the snow is removed within a few days.

4 ALIGNMENT OF A LIGHT-TRAFFIC ROUTE

4.1 Premises of alignment planning

The main premise for planning the alignment of light-traffic routes is to meet the needs of bicyclists in terms of safety, smooth flow and comfort.

A separate light-traffic route must fit in well with the topography, vegetation, surrounding housing and other land use. Light-traffic routes alongside traveled ways usually follow the geometry of the road, giving a high-quality result in terms of cycling ease and safety.

The geometry of main routes is designed for a bicycle speed of 30 kph, and that of local routes for a speed of 20 kph.

4.2 Sight distances between intersections

Any line section should provide the following stopping sight distances for bicyclists:

Route	Stopping sight distance (m)		
	good	satisfactory	poor
Main route	35	30 - 35	20 - 30
Local route	20	15 - 20	10 - 15

The calculations are based on the following assumptions, as well as the design speed:

Standard class	Reaction speed (s)	Deceleration (m/s^2)
good	2	2
satisfactory	2	3
poor	1	3

In sight distance checks, the eye height is 1.5 m and the barrier height at a summit 0.4 m and elsewhere 0 m.

4.3 Horizontal alignment

The minimum curve radii in the different cases are:

Route	Curve radius R (m)		
	good	satisfactory	poor
Main route	30	20 - 30	15 - 20
Local route	20	15 - 20	10 - 15

If mopeds are allowed along the route or the gradient is so steep (≥ 5%) that cycling speeds tend to be high, standard class 'good' must always be chosen.

4.4 Vertical alignment

Transition curves

The minimum transition curve radius at a summit is 50 m. The transition curve at summits is designed according to the stopping sight distance.

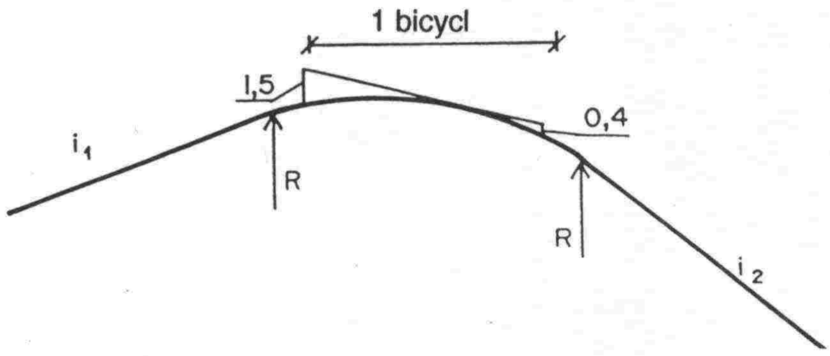


Diagram 4: Determining the transition curve radius at a summit on the basis of sight distance.

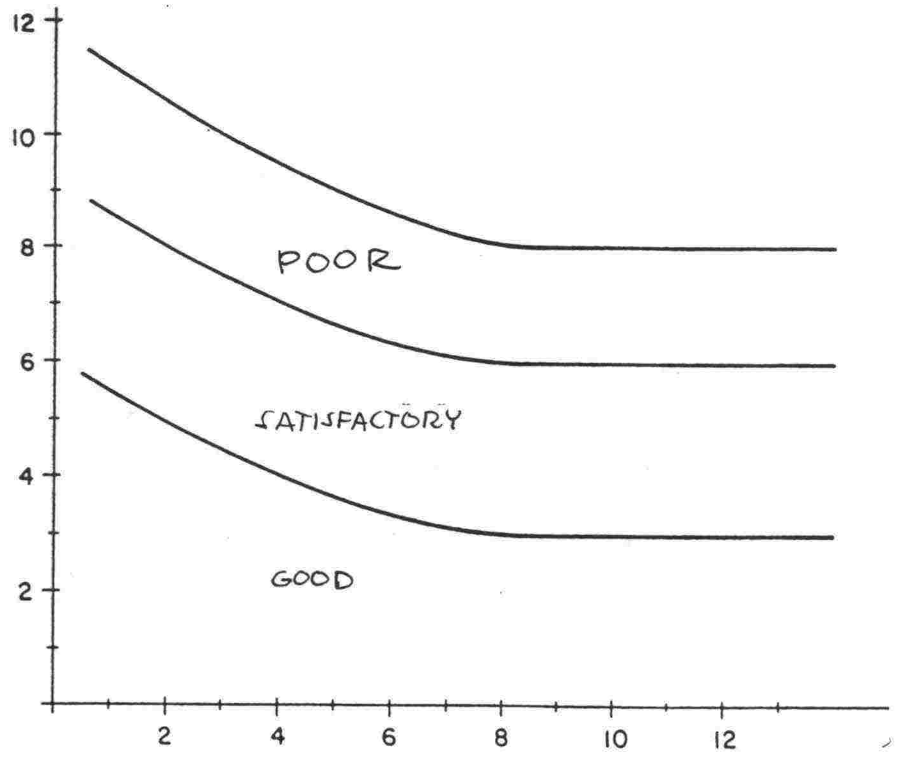
The curve radii in the following table are valid when the length of the curve is greater than the stopping sight distance. When the curve is shorter, a smaller radius is sufficient, and can be determined case by case.

Route	Standard	Summit curve radius S_{min} (m)	Minimum gradient difference (i), with curve sight distance ≥
Main	good	400	9 %
	satis.	300	10 %
	poor	130	15 %
Local route	good	130	15 %
	satis.	75	20 %

Gradient

The maximum values for gradient along main and local routes are shown in diagram 5. 'Good' quality should always be the aim in the case of routes used by the handicapped.

Gradient %



Height difference (m)

Diagram 5: Maximum gradients.

4.4 Steps

Light-traffic routes should, in principle, be planned so as to avoid using steps. Steps must never be the only possible way forward, and there must always be some other option, e.g. a pathway round or an elevator.

Steps are situated where they greatly shorten the distance to be traveled. Typical locations are grade-separated designs close to bus and railroad stops. Uncovered steps have to be kept clear manually in winter. In special cases, they can be closed to users during the winter.

Steps must be located so that there is no chance of falling down them by accident, i.e. at the side of the main routeway or at right angles to it.

The normal recommended gradient of steps is 1:2.5, with a step riser of 120-160 mm and a step width of 300-400 mm. The best step arrangement in terms of human stepping rhythm is one in which the sum of a flat level and two risers is 630 mm. There should be a double hand rail (heights 900 and 750 mm) along at least one side of the steps, and preferably on both. This hand rail must extend at least 300 mm beyond the steps. The rail diameter should be 30-40 mm. The minimum width of two-way steps is 2.0 m. Any long flights of steps should have a rest level (landing) c. 1.5 m long at 2-3 m intervals.

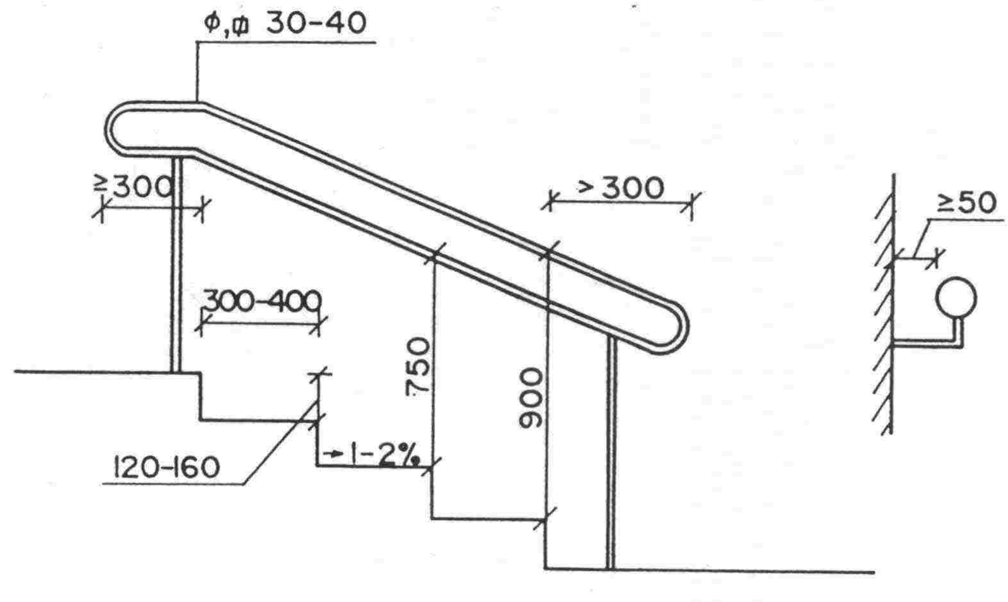


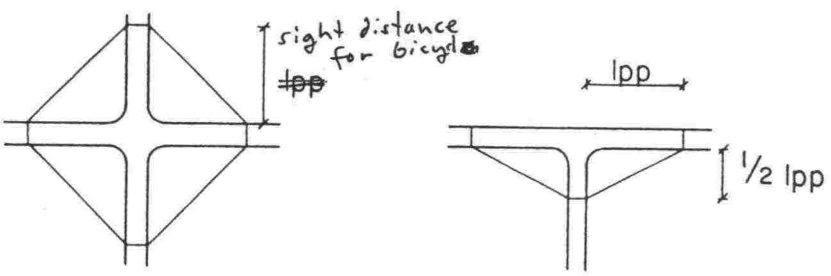
Diagram 6: Design of steps

5 CROSSINGS ALONG THE ROUTE

5.1 Light-traffic crossing points

At light-traffic crossing points, sufficient sight distances must be provided to allow bicyclists to see each other in good time and to be able to stop before the intersection if necessary.

The design speed for an intersection zone along main routes is 20 kph and along local routes 15 kph. The standard class 'good' presupposes that smooth braking is possible, the class 'satisfactory' that braking has to be sharp. In the class 'poor', bicyclists only have a short reaction time as well as having to brake sharply.



Standard	Intersection sight distance for bicycl (m)	
	Main route	Local routes
Good	20	15
Satisfactory	15	10
Poor	10	7

When the gradient of a light-traffic route is greater than 4% at the approach to an intersection, the sight distance must be lengthened 5-10 m, depending on the gradient and the length of the gradient stretch. If the light-traffic route slopes sharply towards the intersection area at a 4-leg intersection, division of the crossing point into two T-intersections must be considered.

The maximum gradients at crossing points of light traffic are as follows:

Standard class	Gradient (%)
Good	2
Satisfactory	2 - 4
Poor	4 - 7

The minimum intersection curve radii along light-traffic routes are 3-6 m, depending on the maintenance equipment used and the widths of the routes.

5.2 Light and motor traffic crossing points

The possible ways of arranging a crossing point between a light-traffic route and a road with motor traffic are as follows:

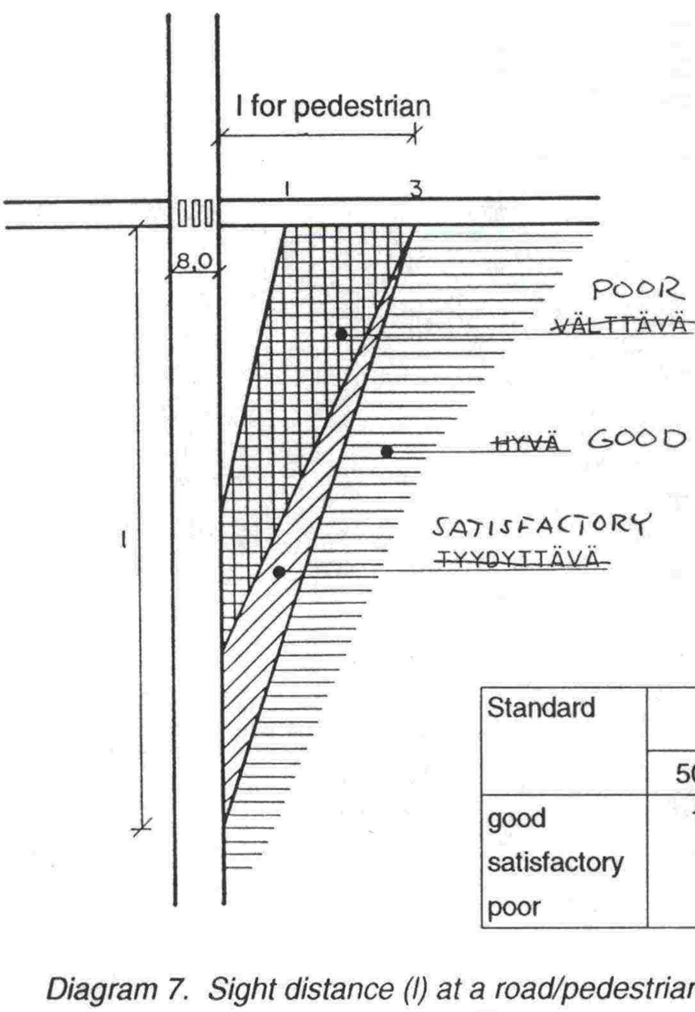
- a crosswalk
- a crosswalk + island
- a crosswalk + traffic signals (+ possibly an island)
- a grade-separated arrangement (under- or overpass)

The choice of crossing arrangement is dealt with in more detail in section 2.4.

5.2.1 Sight distances along the route

Crossing point of main road and pedestrian way

A crossing point between pedestrian and motor traffic must comply with certain sight distance requirements. The minimum sight distance lengths (l) along the road and the pedestrian way in the various standard classes are as shown in Diagram 7 .



Standard	l (m)		l for pedestrian (m)
	50 kph	60 kph	
good	110	140	3
satisfactory	85	110	3
poor	60	75	1

Diagram 7. Sight distance (l) at a road/pedestrian way crossing point.

The sight distances along the main road are based on the following assumptions:

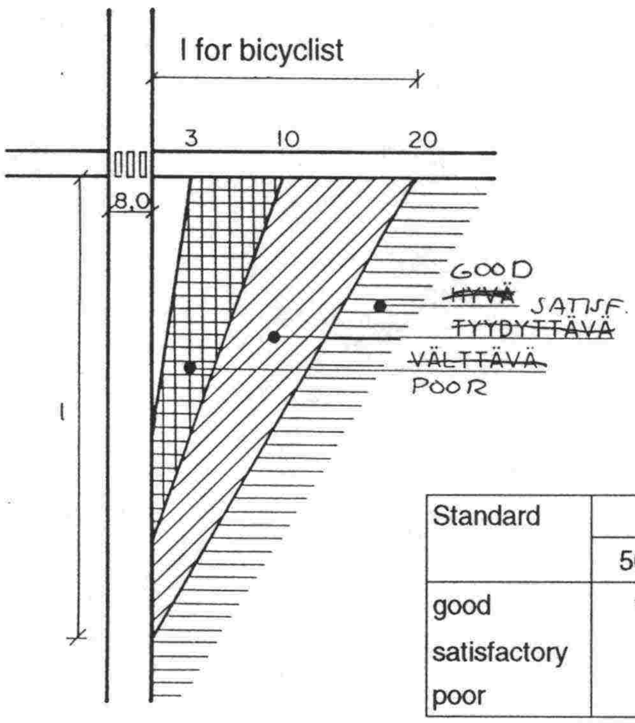
- In the standard 'good', a pedestrian walking at 1.0 m/sec. is able to cross an 8 m wide crosswalk when a car appears at sight distance l.
- 'Satisfactory' assumes a walking speed of 1.4 m/sec. or that a vehicle driving at the design speed slows down.
- In the 'poor' class, there must be at least a satisfactory stopping sight distance for motor vehicles along the traveled way.

The sight distance along the pedestrian way in the 'good' and 'satisfactory' classes is at least 3 m and in the 'poor' class the absolute minimum is 1 m.

If the road is narrower than shown or the point with the crosswalk has been designed for a reduction in travel speed, the sight distances along the road can be reduced correspondingly.

Crossing point of main road and bicycle way

The sight distance requirements for a crossing point between bicycle and motor traffic are shown in diagram 8. In the 'good' class, a bicyclist traveling at 20 kph, and in the 'satisfactory' class a bicyclist traveling at 10 kph, is able to cross an 8 m wide road if a car is just in view at the sight distance, by braking smoothly almost to a halt before the crossing point. In the 'poor' class, a bicyclist always has to stop. The sight distances (l) along the road are the same as at pedestrian crossings.



Standard	l (m)		l for bicycl (m)
	50 kph	60 kph	
good	110	140	≥20
satisfactory	85	110	10 - 20
poor	60	75	3 - 10

Diagram 8: Sight distance at a road/bicycle way crossing point.

If the crossing point is shorter or the car speed is cut before the crosswalk, e.g. using structural means, the sight distance along the road can be reduced correspondingly.

Plantings

Single trees or low bushes can be planted in the sight distance zone. Bushes must not be allowed to grow higher than 0.6 m, however.

5.2.2 Crossing design

Crosswalk

A crosswalk is usually marked out at the same width as the light-traffic route leading to it. The minimum width is 3 m if the route carries both bicyclists and pedestrians. If the amount of cycling is heavy, the recommended width of the crosswalk is $\geq$ 4 m. When the pedestrians and bicyclists are segregated, the extension of the bicycle path should be at least 2.0 m wide. The minimum width of a crosswalk intended solely for pedestrians is 2.5 m.

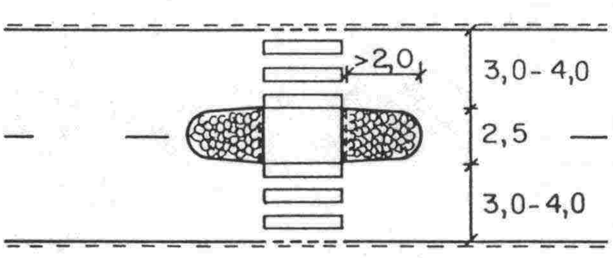
Crosswalk + island

The crosswalk is usually led through the island at the same level as the traveled way. If the island is on a crossway intended solely for pedestrians, the waiting area can be elevated 20-30 mm. The recommended width of the island and the width of the driving lane at the island are as shown in diagram 9.

Standard	Width of crosswalk island (m)	
	Pdstrn	Bicycl
Good	2.50	3.00
Satisf	2.00	2.50
Poor	1.50	2.00

Speed limit	Width of driving lane
50 kph	3.00 - 3.50 m
60 kph	4.00 m

pdstrn + bicycl



pdstrn + bicycl

Diagram 9: An island on a crosswalk.

Grade-separated arrangement

The minimum width of an underpass opening is the width of the light-traffic route + 1 m, but more spacious openings are to be recommended in the interests of light, sight distances and appearance. The recommended minimum width is 6 m. In the case of long underpasses, e.g. under a divided highway, the recommended width is 8 m. Along recreational routes, space should be allocated for a ski trail in an underpass if necessary. One ski trail needs some 1.5 m of space, and a dual trail c. 2.5 m.

In designing the height of an underpass, note must be taken of the space needed for light traffic and maintenance vehicles, together with drainage systems and their cost.

For light traffic, 2.5 m is high enough. However, maintenance vehicles need 2.5-3.2 m. In choosing the right height, the goal must be to achieve a sufficiently high-quality design for the light traffic. A clearance of at least 3.0 m is desirable.

The free space between the railings along an overpass, i.e. the useable width, = the light traffic paving width + 0.5 m. The useable width of an overpass is thus normally 3.5-4.5 m. If space is allowed for a ski trail or pair of trails, the useable widths are correspondingly 4.5 and 5.5 m.

5.2.3 Curb arrangements

The curb arrangements on crosswalks differ from town to town. The following explains the practice approved for FinnRA routes. On crosswalks not intended for bicyclists, a low glued curb is used, or a flush bitumen or natural stone edging (diagram 10).

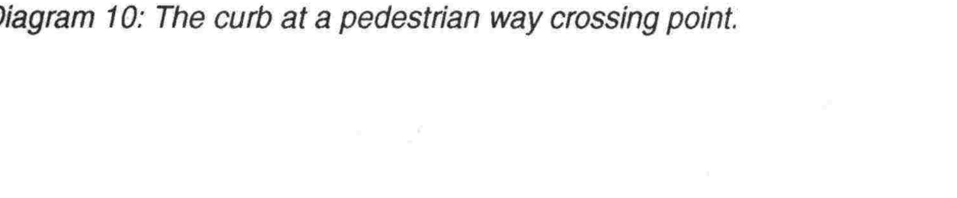


Diagram 10: The curb at a pedestrian way crossing point.

If the crosswalk is also intended for bicyclists, a glued curb is replaced by sloped asphalting.

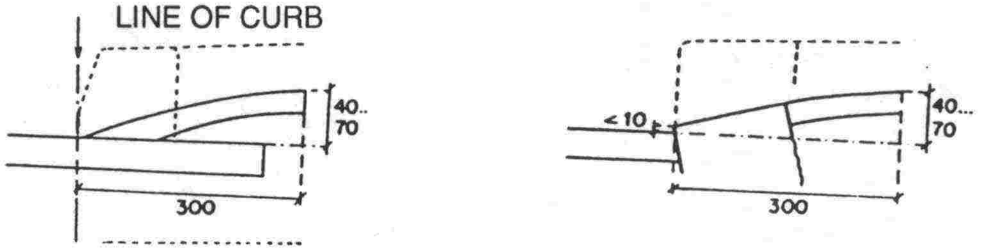


Diagram 11: The curb at a bicycle way crossing point.

The curb is, as a rule, removed along the full width of the crosswalk. If there is a special need to separate off the bicycle way (e.g. a divided way), the curb is only removed along the bicycle way.

When flush curbing is used, the curb can be replaced with sloped asphalting as above or alternately sunk flush with the traveled way. The latter is better than breaking off the curbing in terms of appearance and clarity.

In areas frequented by visually impaired persons, a curb or ordinary sharp-edged sloped asphalting is recommended in the case of a combined way.

6 LIGHT TRAFFIC AT AT-GRADE INTERSECTIONS WITHOUT SIGNALS

A crosswalk is a logical element in a pedestrian and bicycle path. The lack of a crosswalk must not result in any unnecessary shift from one side of the street to another. There should be a crosswalk across every leg of an intersection where there is a continuous light-traffic route.

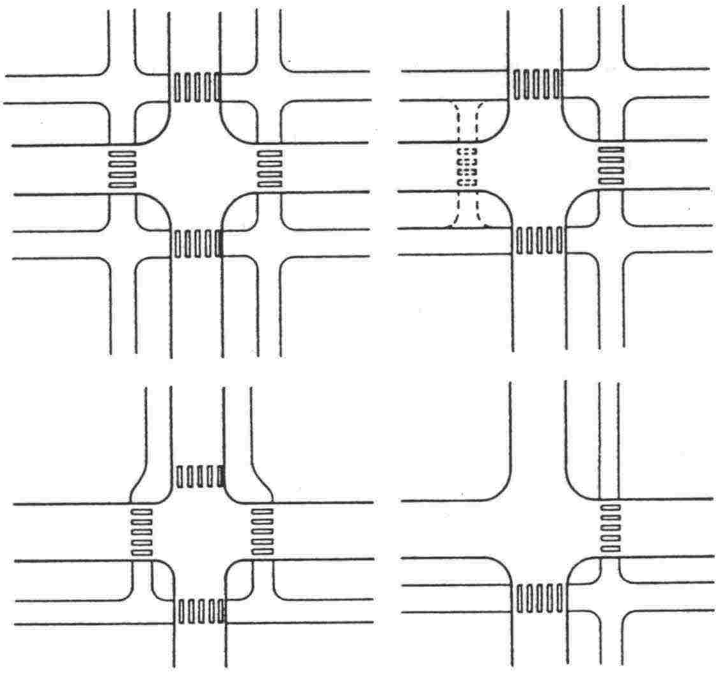


Diagram 12: Crosswalk arrangements.

The alignment of a light-traffic route and the location of the crosswalk at an intersection depend, for instance, on the type of intersection and the light-traffic segregation principle. The intersection principles for street junctions with little traffic in cases where the main road carries a 50 kph speed limit and a parallel way for light traffic with a curb, or with a curb and also segregated from the road by a narrow dividing strip are shown in diagram 13.

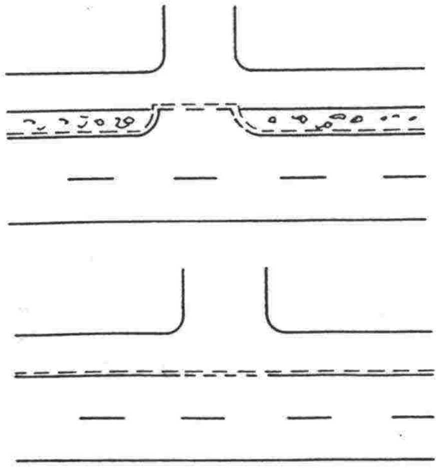


Diagram 13. Intersections with residential and other streets with little traffic are elevated.

At unchannelized intersections with main roads, a crosswalk is placed at a distance of either $L \leq 2$ m or $L = 5$-10 m from the edge of the main-road traveled way, depending on the shape of the intersection. This means there is no uncertainty about right of way, and sufficient sight distances are ensured for both light and motor traffic.

If the crosswalk is right next to the traveled way, light and motor traffic have a good view of each other. With a crosswalk distance of 5-10 m there is space for one parked vehicle between the traveled way and the crosswalk. A crosswalk running farther from the traveled way should be at least 30 m away.

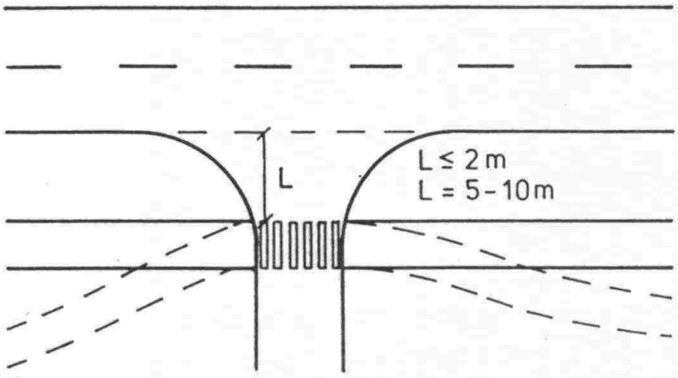


Diagram 14: Crosswalk arrangements at an open intersection with a main road.

If there is an island at the end of the intersecting street, the minimum distance for the crosswalk is determined on that basis (usually ≥ 6 m).

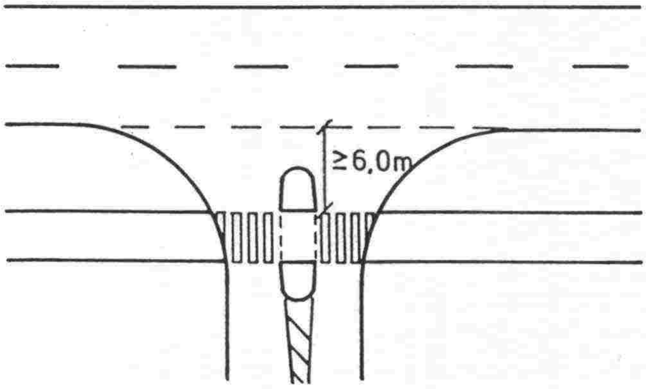


Diagram 15: A crosswalk at an island.

It makes movement easier for the visually impaired if the crosswalk is laid at right angles to the curb. If necessary, a railing can be provided to keep the visually impaired from wandering onto the traveled way.

If the light-traffic route is only on one side of the road, there is a sign on the opposite side indicating that there is a crosswalk over the main road at an intersection carrying light traffic. In the case of a connecting road, the crosswalk should be extended (by way of a sidewalk or path) onto the connecting road so that pedestrian and bicycle traffic will be effectively guided onto the crosswalk. If the connecting road has a sidewalk, bicycle traffic should be arranged as above.

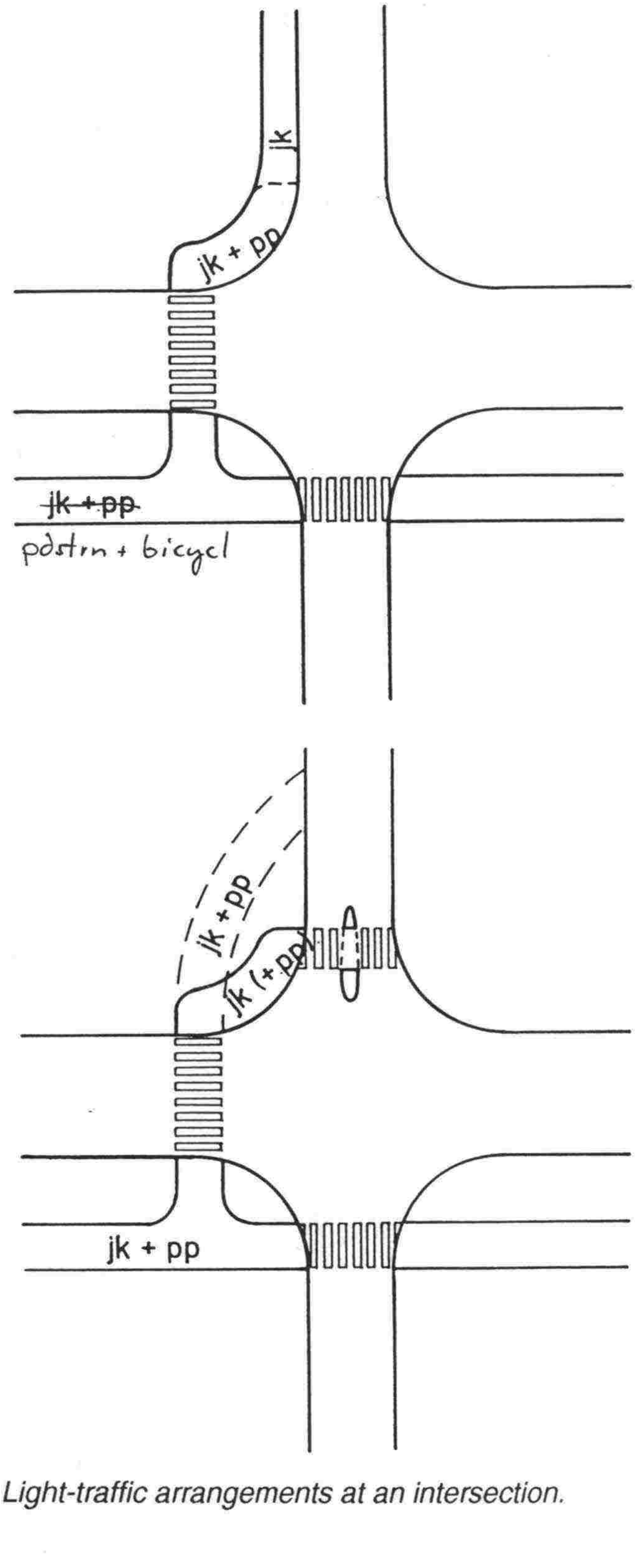


Diagram 16: Light-traffic arrangements at an intersection.

7 LIGHT-TRAFFIC ARRANGEMENTS AT INTERCHANGES

If the land use and present traffic network allow, light-traffic links across a road at an interchange should be grade-separated. However, this must not force the light traffic to make a diversion. Leading the light-traffic route through an interchange for motor traffic usually means providing several crossings between the two types of traffic.

In practice, the existing land use means that light traffic has to be conducted via the interchange. Crossings must then be grade-separated in the interests of safety and smooth functioning. An at-grade crossing is only feasible either at the end of a ramp or across an intersecting lower-class road. Elsewhere, links across ramps must always be grade-separated.

The light-traffic arrangements must be planned at the same time as the rest of the interchange. Bus stops and light-traffic links with them, for instance, must be carefully thought out.

Diagram 17 shows the basic models for light-traffic arrangements at various types of interchange. Bus stops and the necessary light-traffic links are studied in more detail in the report on mass transit.

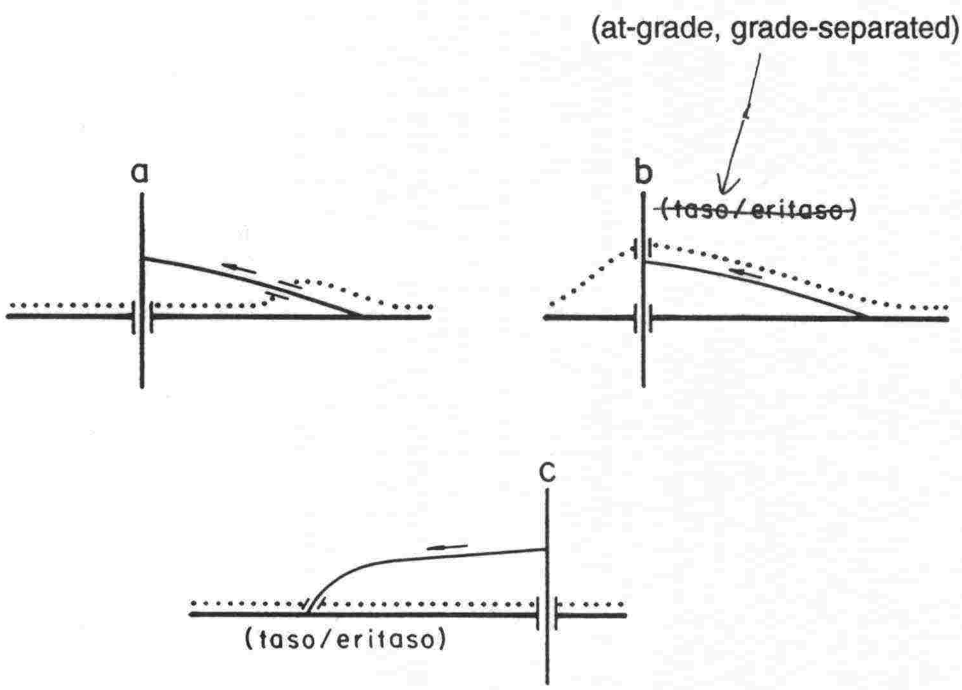


Diagram 17: Examples of how a light-traffic route can be arranged in an interchange zone.